XXXI. IODINE IN CABBAGE.

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IN iodine analyses of foodstuffs the most difficult part of the technique is the destruction of organic matter without the loss of iodine, and therefore only that part of the method will be mentioned, the remainder being given by McClendon [1934, pp. 304–309].

The cabbages were sliced and dried in a current of air at slightly above room temperature, then ground in a mill, and dried in an oven at 100°. Weighed samples were packed in Visking sausage casing and burned in a modified combustion tube (see Fig. 1). The results of the analyses are shown in Table I. In

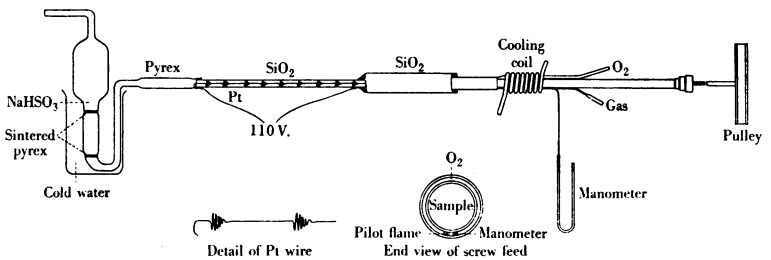

Fig. 1. Apparatus for burning dried tissue for iodine analysis. A detail of the opening of the screw-feed is shown below. The central circle is the space containing the dried tissue packed in a Visking sausage casing and round it is an annular opening from which oxygen issues to burn the tissue (one small circle below is an opening for a gas pilot flame and the other is for the manometer, used to ensure a zero or slightly negative pressure in the combustion tube). The screw is advanced by means of a belt connecting the pulley with the worm reducing gear of an electric motor.

order to compare them with previous data we have computed the average values of samples from two sections of the State. It will be seen that those from one section are higher in iodine than those from the other.

Minnesota may be divided into two portions in relation to goitre and iodine. The most goitrous region and the one containing the least amount of iodine is the Arrowhead region (north-east), which is the region with the least soil on the top of the granite (the soil having been rubbed off by glaciers) and also the region of the greatest rainfall. The region of the most iodine and least goitre is the western part of the State. During the Permian period this region was near the shores of a gulf connected with the Pacific Ocean through Kansas, New Mexico and Arizona, but was cut off later by the rise of the Rocky Mountains. In the intermediate region one of these merges into the other and the division between them is rather indefinite so that for our purposes the line drawn between them has been made rather arbitrarily. In the table the iodine analyses of cabbage

Table I.

West and South Minnesota Counties.

County	Iodine γ/kg. dry: Cabbage	Iodine γ/kg. dry: Potato	Goitre per 1000 draft
Kittson	—	—	17
Roseau	210	—	8
L. of the Woods	—	63	—
Marshall	—	—	8
Pennington	186	—	5
Red Lake	—	—	—
Polk	65	344	10
Beltrami	—	—	4
Hubbard	—	—	6
Becker	160	—	8
Norman	—	—	3
Clay	81	—	—
Wilkin	—	—	13
Ottertail	—	—	6
Wadena	—	179	12
Todd	—	—	4
Douglas	—	—	5
Traverse	—	—	5
Stevens	511	225	—
Pope	—	—	5
Stearns	—	—	7
Meeker	—	—	5
Kandiyohi	152	329	3
Lac qui Parle	—	—	17
Chippewa	—	—	19
Yellow Med.	—	—	2
McLeod	187	135	—
Sibley	—	—	12
Nicollet	—	—	7
Brown	—	—	1
Redwood	—	—	31
Lincoln	—	—	4
Pipe Stone	84	38	5
Murray	258	—	—
Cottonwood	139	—	—
Watonwan	—	—	4
Blue Earth	—	—	2
Waseca	73	565	4
Rock	—	—	12
Martin	164	164	8
Freeborn	114	—	5
Mower	—	—	5
Fillmore	—	—	12
Houston	225	—	27
Average	174	227	8·5

North-east and East Minnesota Counties.

County	Iodine γ/kg. dry: Cabbage	Iodine γ/kg. dry: Potato	Goitre per 1000 draft
Cook	16	32	24
Lake	—	123	31
St Louis	53	117	24
Koochiching	155	172	3
Itasca	—	36	—
Cass	127	—	5
Crow Wing	—	—	—
Aitkin	142	—	7
Carlton	81	—	39
Pine	238	118	19
Kanabec	—	—	—
Mille Lacs	53	127	—
Benton	83	—	8
Sherburne	—	—	10
Isanti	—	—	—
Chisago	—	—	22
Anoka	—	75	4
Washington	—	—	38
Ramsey	123	—	3
Hennepin	100	—	11
Wright	—	—	10
Carver	—	—	9
Scott	—	—	—
Dakota	88	—	22
Rice	—	—	5
Goodhue	100	—	15
Wabasha	192	—	37
Winona	—	106	30
Dodge	—	—	19
Average	111	101	17·2

are compared with those by McClendon *et al.* [1934] on potato, together with the goitre per thousand drafted men during the Great War. No data are available for Clearwater, Grant, Swift, Big Stone, Renville, Lyon, Nobles, Jackson, Faribault or Olmsted counties in the south-west section or for Isanti or Scott in the east-north-east section. In the east-north-east there were cabbages from 14 counties, potatoes from 9, and Draft Board data on goitre from 37. In the east-north-east section the average value of iodine in cabbage was 111 γ/kg. dry material, in potato 101, and goitre 17·2 per thousand men. In the west-south, iodine in γ/kg. cabbage (dry) averaged 174, in potato 227, and goitre per thousand drafted men 8·5 (the War Department defined goitre as a neck too large to button a military collar round).

These data indicate that goitre is associated with iodine deficiency in the foodstuffs eaten as well as in the water drunk, as shown by previous analyses. McClendon and Hathaway found 0·01 γ/kg. in the only drinking water not contaminated with sewage in the east-north-east section that was examined, whereas in the west-south section the 4 samples analysed contained 0·05, 0·05, 0·08[1] and 0·14 γ/kg. The work on water was undertaken on the assumption that the iodine content of drinking water was related in some way to the iodine content of water soaked up by plants and evaporated from the leaves and hence to the iodine content of the plants. This water is evaporated from the leaves of plants and hence iodine is concentrated in the leaves. The potato was first chosen because it was easy to obtain, but later cabbage was chosen because it consists of leaves. From the samples available the outer leaves, open to free evaporation, had been removed, and hence the iodine content was lower than it would be in such expanded leaves in which the iodide sucked up by the roots with the soil water is concentrated by evaporation. Owing to the fact that cabbage was the only leafy vegetable obtainable from these counties we have had to content ourselves with analyses of food of relatively low iodine content.

[1] River with sewage from 5000 population, whereas water omitted from east-north-east study contained sewage from about 100,000 population.

REFERENCES.

McClendon (1934). Manual of biochemistry. (Wiley, New York.)
—— Barrett and Canniff (1934). *Biochem. J.* **28**, 1209.